CULINARY WATER MASTER PLAN AND IMPACT FEE FACILITIES PLAN AMENDED MAY 2019

J-U-B: #55-16-017

Prepared by:

J-U-B ENGINEERS, INC.

GATEWAY MAPPING INC.
a J-U-B Company

TABLE OF CONTENTS

Impact Fee Facilities Plan Certification iv
EXECUTIVE SUMMARY v
1 - INTRODUCTION 1
2 – GROWTH AND PROJECTIONS 3
3 - EXISTING SYSTEM EVALUATION 7
3-1 Existing Demands 7
3.1.1 Average Annual Demand 7
3.1.2 Peak Day Demand 8
3.1.3 Peak Hour Instantaneous Demand 10
3-2 Existing Water Sources / Supply 10
3.2.1 Capacity 10
3.2.2 Level of Service and Evaluation 11
3-3 Existing Water Rights 12
3.3.1 Capacity 12
3.3.2 Level of Service and Evaluation 14
3-4 Existing Water Storage 15
3.4.1 Capacity 15
3.4.2 Level of Service and Evaluation 17
3-5 Existing Water Distribution System 18
3.5.1 Condition 18
3.5.2 Modeling 19
3.5.3 Level of Service and Evaluation 19
4 – FUTURE SYSTEM EVALUATION 21
4-1 Future Demands and Level of Service 21
4-2 Future Water Sources / Supply and Water Rights 22
4-3 Future Water Storage 28
4-4 Future Water Distribution System 32
5 - System Deficiencies and Reserve Capacity 33
5-1 Water Sources / Supply and Water Rights 33
5-2 Water Storage 34
5-3 Water Distribution 35
5-4 Cost of Excess Capacity 36
6 - Projects to Address Deficiencies 37
6-1 Projects to Address Existing System Deficiencies 37
6.1.1 Water Sources / Supply and Water Rights 37
6.1.2 Water Storage 37
6.1.3 Water Distribution System 37
6-2 Projects to Address Future System Deficiencies and Growth 37
6.2.1 Water Sources / Supply and Water Rights 37
6.2.2 Water Storage 38
6.2.3 Water Distribution System 38
7 – PRIORITIZED IMPROVEMENTS COSTS AND SCHEDULE 39

7-1 Summary of Costs 39
7-2 Improvements Schedule 40
8 – CONCLUSIONS AND RECOMMENDATIONS 41
9 - References 42

APPENDICES

APPENDIX A – Fee Schedule
APPENDIX B – Figures
Figure 3-1: Existing Service Area and Existing Water System
Figure 3-2: Existing System Peak Day System Pressure
Figure 3-3: Existing System Peak Day Plus Fire Flow System Pressure
Figure 4-1: Future Service Area and Proposed Water System
Figure 4-2: Future/Proposed System Peak Day System Pressure
Figure 4-3: Future/Proposed System Peak Day Plus Fire Flow System Pressure
Figure 6-1: Future System with Pipelines
Figure 7-1: Projects to Address Future Deficiency
APPENDIX C – Model Results
APPENDIX D – Detailed Cost Estimates
APPENDIX E - Contracts

TABLE OF TABLES

Table 1-1: Culinary Water Connection and Impact Fees and Maximum Operating Flow[1] 1
Table 1-2: Culinary Water Utility Rates[1] 2
Table 2-1: Population and ERCs 4
Table 2-2: Estimated Future ERCs 6
Table 3-1: Average Monthly Unmetered Water 9
Table 3-2: Summary of Demands/Level of Service 10
Table 3-3: Existing Water Supply Rate 11
Table 3-4: Existing Water Sources/Supply: Demand and Capacity 12
Table 3-5: Drinking Water Rights – Status[1] 13
Table 3-6: Drinking Water Rights – Quantity[1] 13
Table 3-7: Existing Water Rights: Demand and Capacity 14
Table 3-8: Existing Water Storage 16
Table 3-9: Existing Water Storage: Demand and Capacity 17
Table 3-10: Distribution System Breakdown 18
Table 3-11: Distribution System Age 18
Table 3-12: Existing Water Distribution System: Demand and Capacity 20
Table 4-1: Summary of Level of Service and Demands 22
Table 4-2: Peak Day Source Water Supply Assessment for Planning Period 23
Table 4-3: Annual Average Source Water Supply Assessment for Planning Period 24
Table 4-4: Peak Diversion Water Right Assessment for Planning Period 25
Table 4-5: Annual Water Right Assessment for Planning Period 26
Table 4-6: Storage Assessment for Planning Period 30

Table 5-1: Peak Day Water Sources Excess Capacity/Deficiency 33
Table 5-2: Average Annual Water Sources Excess Capacity/Deficiency..... 34
Table 5-3: Peak Day Water Rights Excess Capacity/Deficiency 34
Table 5-4: Average Annual Water Rights Excess Capacity/Deficiency 34
Table 5-5: Water Storage Excess Capacity/Deficiency 35
Table 5-6: Water Distribution Excess Capacity -Year 2016..... 36
Table 7-1: Project costs to Address Existing Deficiencies..... 39
Table 7-2: Project costs to Address Future Deficiencies 39

IMPACT FEE FACILITIES PLAN CERTIFICATION

I certify that the attached impact fee facilities plan:

1. Includes only the costs of public facilities that are:
    a. allowed under the Impact Fees Act; and
    b. actually incurred; or
    c. projected to be incurred or encumbered within six years after the day on which each impact fee is paid; and
    d. existing deficiencies are documented as such and are not meant for inclusion in the impact analysis.

2. Does not include:
    a. costs of operation and maintenance of public facilities;
    b. costs for qualifying public facilities that will raise the level of service for the facilities, through impact fees, above the level of service that is supported by existing residents; and
    c. an expense for overhead, unless the expense is calculated pursuant to a methodology that is consistent with generally accepted cost accounting practices and the methodological standards set forth by the federal Office of Management and Budget for federal grant reimbursement.

3. Complies in each and every relevant respect with the Utah Impact Fees Act.

_____

SYRACUSE CITY

CULINARY WATER MASTER PLAN AND IMPACT FEE FACILITIES PLAN

May 2019

EXECUTIVE SUMMARY

This is an amendment to the Culinary Water Master Plan and Impact Fee Facilities Plan dated January 2017. This Water System Master Plan is a document to guide City officials and staff in making decisions relating to future issues with the City's culinary water system. In the document, water resources supply, storage and distribution are reviewed for existing conditions and future conditions at build-out of the community. A summary of costs and projects are included in later chapters of the report.

1 - INTRODUCTION

Syracuse City is a growing community located in northern Davis County. With growth many challenges arise. One of these challenges is planning for culinary and secondary water impacts that the community will face in the future. This Culinary Water Master Plan and Impact Fee Facilities Plan will serve as a guide for community decisions to be made by the City council and staff. Guidance regarding supply and sources, storage and distribution improvements will be given to allow the City to make informed decisions regarding water resources into the future.

The last Culinary Water Impact Fee Facilities Plan was done by Epic Engineering in January 2007. It is titled the *Culinary Water Impact Fee Update*.

Effective as of July 1, 2016 the culinary water connection fees and impact fees are as follows from the Consolidated Fee Schedule in Table 1-1.

Table 1-1: Culinary Water Connection and Impact Fees and Maximum Operating Flow[1]

Meter Diameter (inch)	Connection Fees (ea. Unit)	Impact Fees (ea. Unit)	Maximum Operating Flow
¾	$325.00	$966.00	30
1	$485.00	$1,610.00	50
1 ½	$680.00	$4,999.00	100
2	$983.00	$7,997.00	160
3	$1,699.50	$15,994.00	320
4	$3,005.00	$24,991.00	500
6	$4,782.00	$49,981.00	1,000
8	$7,143.00	$79,970.00	1,600

1. See also Appendix A for the full fee schedule.

The deposit for water service is $75.00 per residential application and $100.00 per commercial/industrial/multi-family application.

Developers are not required to bring “wet” water for the culinary water system as part of the agreement to develop an area. Instead, they pay as noted in the tables above.

The utility rates for culinary water service are as follows in Table 1-2.

Table 1-2: Culinary Water Utility Rates[1]

Type of Service	Current Base Fee (ea. Unit)	Additional Fee
Private Pool – Above Ground Permanent	$2.20/ 1,000 gallons	NA
Commercial Construction (not to be pro-rated)	$2.20/ 1,000 gallons	NA
Commercial Service		NA
<10,000 gallons	$16.50/ month	NA
10,001-30,000 gallons	$1.65/ 1,000 gallons	NA
30,001-40,000 gallons	$2.05/ 1,000 gallons	NA
>40,000 gallons	$2.65/ 1,000 gallons	NA
Residential Service (with secondary water)		NA
<8,000 gallons	$16.50/ month	NA
8,001-15,000 gallons	$2.05/ 1,000 gallons	NA
>15,000 gallons	$2.45/ 1,000 gallons	NA
Residential Service (without secondary water)		NA
<8,000 gallons	$16.50/ month	NA
8,001-15,000 gallons	$2.20/ 1,000 gallons	NA
15,001-20,000 gallons	$2.75/ 1,000 gallons	NA
>20,000 gallons	$4.10/ 1,000 gallons	NA
All Non-Residential Service		NA
<8,000 gallons	$22.50/ month	NA
8,001-15,000 gallons	$2.20/ 1,000 gallons	NA
15,001-20,000 gallons	$2.75/ 1,000 gallons	NA
>20,000 gallons	$4.10/ 1,000 gallons	NA

1. See also Appendix A for the full fee schedule.

2 – GROWTH AND PROJECTIONS

The 2014 population in Syracuse City, according to the U.S. Census Bureau, was 26,639 (U.S. Census Bureau, 2014). The growth rate from 2010 to 2014 was 9.3 percent (U.S. Census Bureau), which was a 2.3 percent annual rate of change. The growth rate from 2000 to 2010 was 149.73 percent, which was nearly a 15 percent annual rate of change. The future growth rate is anticipated to range from 4.7 percent in the early years to 2.1 percent as the City approaches build-out (Syracuse, 2014). The residential growth rate is as shown in Table 2-1. The growth rate was established by the City in previous reports (Syracuse, 2014).

The persons per residential connection were established by dividing the population by the number of residential connections. The city provided the number of residential connections for 2014, 2015 and 2016. Based on the 2014 population and the growth rates determined by the increase in the number of residential connections, the population for 2015 and 2016. The people per residential connection is the population divided by the residential connections. For 2014-2016 the average persons per residential connection was 3.86, which was used to determine the future residential connections from the population (Syracuse, 2016). In 2014 there were 6,964 residential connections.

A standard residential unit is the basic unit used for calculating demand on the system. Water users that differ from a basic residential unit are considered to be a multiple of a residential unit depending on the expected water use. Non-residential connections were estimated from water usage records and converted to equivalent residential connections (ERC). The residential connections and equivalent residential connections were summed for each demand region and the City as a whole.

Culinary water meter readings from 2013, 2014, and 2015 (partial year) were obtained from the City and used to determine the water usage for the system. The total overall average water use for the system was 37.027 Million gallons/month. The residential monthly water usage was 35.493 Million gallons/month (95.9% of the total). The residential water usage also includes sources listed by the City as “unknown.” The residential water use (35.493 Mgal) was divided by the residential connections (6,964), resulting in 5,097 gallons/ connection/ month. Monthly water usage in 2013, 2014 and 2015 was analyzed and the commercial, industrial and institutional water users were broken out. The commercial, industrial and institutional water users (C&I) used an average of 1,533,913 gallons/month during 2013 to 2015. In order to convert the non-residential water use (C&I use) to equivalent residential connections (ERCs), the 4,997 gal/conn/mo was divided by the non-residential water use (1.534 Mgal/month). This resulted in 301 non-residential equivalent residential connections (ERCs) and 7,265 ERCs total in 2014. The non-residential connections are assumed to increase at 1.49% per year. This growth rate is based on the growth rate necessary to arrive at the City projected number of ERCs at buildout. This growth rate was confirmed as reasonable by the City. The total existing equivalent residential connections, including residential, multi-family, small and large commercial and industrial users, calculated for the year 2016 is 7,730.

There are 7,540 existing metered connections as of June 2016 based on information provided by the City. This includes single family, multiple family residential structures, lots that have an active water meter installed, commercial, industrial and institutional. Multiple units that share one meter are counted as multiple ERCs.

Table 2-1: Population and ERCs

Year	Population[1]	Res. Growth Rate[2]	People/ Res. Conn.[3]	Total Res. Conn.	C&I Growth Rate[4]	C&I ERC[5]	Total ERCs[5]	New ERCs
2014	26,639	4.7%	3.83	6,964	1.49%	301	7,265	-
2015	27,881	3.27%	3.88	7,192	1.49%	305	7,497	232
2016	28,794	3.17%	3.88	7,420	1.49%	310	**7,730**	233
2017	29,707	4.1%	3.86	7,694	1.49%	315	8,009	279
2018	30,922	3.9%	3.86	8,009	1.49%	319	8,328	319
2019	32,137	3.8%	3.86	8,324	1.49%	324	8,648	319
2020	33,352	3.6%	3.86	8,638	1.49%	329	8,967	320
2021	34,567	3.5%	3.86	8,953	1.49%	334	9,287	320
2022	35,782	3.4%	3.86	9,268	1.49%	339	9,607	320
2023	36,997	3.3%	3.86	9,583	1.49%	344	9,926	320
2024	38,212	3.2%	3.86	9,897	1.49%	349	10,246	320
2025	39,427	3.1%	3.86	10,212	1.49%	354	10,566	320
2026	40,642	3.0%	3.86	10,527	1.49%	359	**10,886**	320
2027	41,857	2.9%	3.86	10,841	1.49%	365	11,206	320
2028	43,072	2.8%	3.86	11,156	1.49%	370	11,526	320
2029	44,287	2.7%	3.86	11,471	1.49%	376	11,847	320
2030	45,502	2.7%	3.86	11,786	1.49%	381	12,167	320
2031	46,717	2.6%	3.86	12,100	1.49%	387	12,487	320
2032	47,932	2.5%	3.86	12,415	1.49%	393	12,808	320
2033	49,147	2.5%	3.86	12,730	1.49%	399	13,128	321
2034	50,362	2.4%	3.86	13,044	1.49%	405	13,449	321
2035	51,577	2.4%	3.86	13,359	1.49%	411	13,770	321
2036	52,792	2.3%	3.86	13,674	1.49%	417	14,091	321
2037	54,007	2.2%	3.86	13,989	1.49%	423	14,411	321
2038	55,222	2.2%	3.86	14,303	1.49%	429	**14,732**	321

1. The 2014 population is based on the U.S. Census Bureau and build-out is based on the City's General Plan Map (Syracuse, 2015).
2. The residential growth rate, which varies, is from the City's Water Rights Report (Syracuse, 2014).
3. The persons per residential connection was calculated for years 2014-2016 based on the projected population divided by the residential connections. For the years 2017-2038 the persons per connection is an average of those calculated for the years 2014-2016.

4. The non-residential, commercial and industrial, growth rate of 1.49% is based on the growth rate necessary to arrive at the City projected number of ERCs at buildout. This was confirmed as reasonable by the City.
5. The C&I/non-residential ERCs are based on the total residential water use divided by the number of residential connections, then that resulting gallons/connection/month divided by the non-residential water use to arrive at a total number of non-residential ERCs.
6. The total ERCs is the sum of the residential connections and the non-residential ERCs.

The future service area includes both the city boundary and the future annexation area. Syracuse City anticipates that the boundaries of the city will increase over time as demand for growth increases. Much of the surrounding undeveloped land is unincorporated and is not adjacent to neighboring municipalities. Future demands on the system will occur in sections of the City already developed, in currently undeveloped areas of the city, and in the future annexation areas. Future demands on the water system have been estimated based upon the land use classifications established by the City's General Plan (Syracuse City, 2015). However, this analysis is based on what is currently adopted and master planned for future development (Syracuse City, 2015). As such, changes to this plan may be necessary as growth proceeds. All areas of future demand were assumed to have pressure irrigation available.

Future demands were calculated by multiplying the gross acreage in a development zone by a density factor that represents equivalent residential connections per acre at build-out. This projection was done for just undeveloped areas and future annexation areas. No "in-fill" of established areas as neighborhoods mature was considered. The result was a conservatively high projected number of ERCs if development occurs in conformance to the land use plan. Density factors used conform to the Future Land Use Plan. Most growth is planned to occur in either undeveloped agricultural areas (areas zoned A-1) or undeveloped residential areas (areas zoned R-1). Table 2-2 shows the estimated future ERCs based on developing currently undeveloped areas. It is expected that changes will occur over time to both the service boundaries and land densities (Syracuse City, 2014).

It is estimated that, using the above procedure, future development will result in 7,002 additional ERCs. When the future estimated ERCs are added to the existing 7,730 ERCs, the resulting number of ERCs at build-out will be 14,732, which will occur in 2038. See Table 2-2. This number of ERCs includes new growth in undeveloped areas within the city and undeveloped planned annexation areas. The estimates do not anticipate a high water use industry. Proposed development that would use significantly more water than typical residential development should be analyzed on a case by case basis.

Table 2-2: Estimated Future ERCs

Zone	Area (Acres)[2]	Density (ERCs/Acre)[1]	ERCs
A-1	857.56	0.50	429
R-1	1,292.13	2.30	2,972
R-2	292.45	3.00	877
R-3	56.04	4.00	224
R-4	0.00	11.00	-
PRD	87.84	6.00	527
General Commercial	445.44	3.50	1,559
Industrial	141.36	0.50	71
Institutional	16.96	0.50	8
Neighborhood Services	3.59	2.00	7
Professional Office	2.36	2.00	5
Research Park	161.17	2.00	322
TOTAL	**3,357**		**7,002**
Estimated Existing (2016) ERCs			7,730
Sum (estimated buildout ERCs)			**14,732**

1. The density (ERCs/acre) is from the December 24, 2015 General Plan map.
2. The undeveloped areas within the City boundary were estimated by the City (Syracuse City, 2015). The undeveloped areas within the Planning Area and not within the City boundary were estimated by J-U-B Engineers as part of this project.

Unmetered water usage used for leaks, flushing, construction, and City usage is not counted toward the ERC total and is added separately to the model. The number of ERCs may not directly correlate with previous reports.

For the model it was assumed that all of the existing connections had secondary water available for outdoor uses.

3 - EXISTING SYSTEM EVALUATION

The current service area of the Syracuse City culinary water system is the current Syracuse City boundary plus a small number of neighboring services in Davis County (Syracuse City, 2014). Appendix B contains a map, Figure 3-1, showing the existing service area and the existing water system.

3-1 EXISTING DEMANDS

The existing demand was calculated to determine existing deficiencies in the City's water system. Then, the existing demand was input into the water model and various scenarios of flow conditions were evaluated, including fire flow scenarios. From these scenarios, areas of low pressure or flow (deficiencies) can be discovered.

The existing demands are a function of the existing ERCs. Chapter 2 above provides more detail on the population and ERCs.

Several types of demand are used for calculating water usage, including the average annual, peak month, peak day and peak instantaneous demand. Average annual demand (the average use over a 12-month period) is estimated by the State of Utah based on 146,000 gallons per ERC per year for indoor use.

3.1.1 Average Annual Demand

The Utah State Administrative Code (UAC) publishes minimum requirements for the average annual indoor demand in UAC R309-510. The average annual demand is 146,000 gallons per ERC per year (UAC, 2016).

The average day observed values are averages of Syracuse monthly meter records for April through October for 2013, 2014 and 2015. The City does not read their water meters from November through March, so meter records from April were divided by 6 months.

- Average Annual – State of Utah Minimum Requirement (Indoor Use)

Indoor Use:

146,000 gal/ERC/year X 7,730 ERC	= 1,129 M gallons per year
	= 3.091 M gallons per day
	= 2,147 gallons per minute
	= 3,464 AF/year

- Average Annual – Observed (based on 3 yr. avg., 2013 - 2015)

61,161 gal/yr/ERC X 7,730 ERC	= 473 M gallons per year
	= 1.295 M gallons per day
	= 899 gallons per minute

= 1,451 AF/year

The observed values are approximately 42 % of the State of Utah minimum required values. The observed values will be used as the level of service, so as to not over estimate the amount of water needed during demand projections.

3.1.2 Peak Day Demand

The peak day demand is the highest demand the system will experience during a 24-hour period, however it is over a very short period of time. The peak day demand was used for modeling and evaluating the storage requirements.

Guidelines established by the State of Utah estimate peak day demand at 800 gallons per day per ERC or 0.560 gpm/ERC (UAC R309-510). This peak day is to be used unless there are measured flows on the system.

The peak month demand was calculated by averaging meter records for June, July and August for the years 2013, 2014 and 2015. Syracuse reads meters April through October, and not November through March, which results in a high reading for April to account for the unread winter months. The average monthly peak value over the 3 years and 3 highest months was 0.119 gpm/ERC. The ratio between the average day and peak month demands is 1.02 (0.119 gpm/ERC / 0.116 gpm/ERC). This indicates that use from month to month is fairly constant because of the use of the secondary water system for irrigation during the summer months.

The meter records do not provide daily flow records. Therefore, the peak day demand (the highest 24-hour period of the year) was calculated by multiplying the peak month demand (the highest month of the year) by an assumed factor of 2. A typical municipal culinary water system has a peak day demand that is twice that of the peak month demand. This results in a peak day demand of 0.237 gpm/ERC, but this does not include un-metered water.

By comparing the sum of water used at individual meters to that from the sources (Weber Basin Water Conservancy District and the well), it was determined that there is unmetered water usage in the system. This unmetered usage is for water used at City owned facilities, construction water, leaks, flushing the system, fire hydrant testing, and etc. For the 2013-2015 data set, the average monthly unmetered flow rate is 376 gpm, which is 607 acre-feet/year. The unmetered water usage is added to the peak day demand used in the model to evaluate the existing system. Table 3-1 compares the water use at individual meters to the sources. The difference is the unmetered water. This results in a peak day demand of 0.286 gpm/ERC.

Table 3-1: Average Monthly Unmetered Water

Year	WBWCD Metered (gal/mo)	Syracuse Well (gal/mo)	Total (gal/mo)	Syracuse Metered at User (gal/mo)	Unmetered (gal/mo)
2013[1]	45,427,250	9,865,266	49,537,778	33,678,524	15,859,254
2014	48,555,583	16,645,853	54,104,201	35,606,429	18,497,772
2015	51,035,167	9,360,439	54,155,313	41,798,595	12,356,718
Overall Average (gal/mo)	48,339,333	11,796,269	52,599,097	37,027,849	16,532,607
Overall Average (gpm)	1,686	1,101	269	1,198	**376**

1. 2013 data is for May through October. Well data is only available for September in 2013.
2. The numbers in the table are averages. Therefore, "WBWCD Metered" + "Syracuse Well" will not necessarily equal "Total." Likewise, "Total" – "Syracuse Metered at User" will not necessarily equal "Unmetered." In addition, the overall average for "Unmetered" excludes estimates and uncertain data.

Peak day flows are compared below.

- Peak Day – State of Utah Minimum Requirement (Indoor Use)

0.560 gpm/ERC X 7,730 ERCs = 6.184 M gallons per day
= 4,294 gallons/minute (gpm)

- Peak Day – Observed (2.5 yr. avg., 2013 - 2015)

0.237 gpm/ERC X 7,730 ERCs = 1,834 gpm
Unmetered usage = 376 gpm
Total existing usage = 2,212 gpm

Unmetered usage 2,212 gpm / 7,730 ERCs = 0.286 gpm/ERC

The State's minimum required value of 0.56 gpm/ERC is a very conservative peak day flow estimate when compared with the observed flow of 0.286 gpm/ERC. The observed peak day data is 52 percent of the State's value. A typical municipal peak day demand is 0.3 gpm/ERC. Therefore, the observed values will be used as the level of service, so as to not over estimate the amount of water needed during demand projections.

The 0.286 gpm/ERC is the value for the existing demand that has been used in the existing model to assess current pipe sizes, service pressures, and residual pressures from fire flow demands, and to evaluate source and storage requirements. The State requires that the average yearly demand of 146,000 gallons/ ERC and peak day demand of 800 gpd/ ERC are the minimum sizing requirements for indoor water use unless a public water system has obtained a reduction per R309-510-5. UAC R309-510-5 states that "water systems that want to use

system-specific design criteria that are below the state's minimum sizing requirements may submit a request for a reduction to the Director. Each request shall include supporting information justifying the reduction in source, storage, or pipeline sizing."

3.1.3 Peak Hour Instantaneous Demand

The peak hour (instantaneous) demand was calculated as 1.5 times the peak day demand, which is typical for Utah municipalities using secondary water. The peak instantaneous demand was used for modeling and evaluating the distribution system requirements. The instantaneous peak is also used to verify the capacity of the distribution system and that the State pressure requirements are met. The instantaneous peak includes the unmetered water usage.

The instantaneous peak (peak hour of the peak day) was calculated as 0.429 gpm/ERC.

- Instantaneous Peak – Observed (2.5 yr. avg., 2013 - 2015)

0.429 gpm/ERC X 7,730 ERCs = 3,318 gpm

Table 3-2 shows a summary of the average annual, peak day and peak instantaneous demands based on observed flow data. These demands will be used as the existing level of service to evaluate the capacity of the existing infrastructure.

Table 3-2: Summary of Demands/Level of Service

Description	Gal/yr/ERC or gpm/ERC	gpm	af/yr	cfs
Average Annual Demand				
Observed	61,161	899	1,451	2.00
Peak Day Demand				
Observed[1]	0.286	2,212	3,568	4.93
Peak Instantaneous Demand				
Observed[1,2]	0.429	3,318	5,352	7.39

1. Includes unmetered water.
2. Based on peak day observed data.

3-2 EXISTING WATER SOURCES / SUPPLY

This Master Plan and Impact Fee Facilities Plan does not discuss the condition of the City's water sources or supply. The City's system is relatively new.

3.2.1 Capacity

The vast majority of Syracuse's current water supply comes from the Weber Basin Water Conservancy District (WBWCD) with the balance being supplied by the City's well. The water from WBWCD enters the city through Clearfield City through a pressure reducing valve at 589

West in 1700 South. Another connection exists directly from Weber Basin at 250 South and 1000 West.

The current contract with Weber Basin is for 1,925 AF/yr with an ability to peak at a rate of 2,400 gpm. The City is limited to a peaking factor of 2.0, which is determined by the maximum daily flow rate divided by the average daily flow rate. The average daily flow rate is the total annual contracted water under this and all other contracts between Syracuse and WBWCD divided by 365. If the peaking factor is exceeded, a capacity surcharge will be added to the cost of treatment and delivery. The surcharge is calculated at 20% of the then current water rate per acre foot of all contracted water multiplied by the difference between the actual daily summer peaking factor the allowed daily summer peaking factor of 2.0.

This 2,400 gpm flow rate will be used in the source analysis for the peak day scenario, while the 1,925 AF/yr will be used when evaluating the annual projected use. The existing well can be used to supplement supply if needed to assure the contract amount is not exceeded. Typically, the well is used only in the summer months and is set at 200 gpm, but this varies from 75 to 773 gpm. The maximum output of the well pump is 1,600 gpm. The WBWCD peak supply rate combined with the rated capacity of the existing well gives a peak water source supply rate of 4,000 gallons per minute as outlined in Table 3-3.

Table 3-3: Existing Water Supply Rate

Source	Typical Use (gpm)	Maximum Supply (gpm)	Maximum Supply (AF)
Existing Well #3: 589 West and 1700 South	200	1,600	2,581
Existing WBWCD Source 1: PRV at 1700 South and 589 West	1,193 (contract: 1,925 acre-feet)	2,400	1,925
Existing WBWCD Source 2: 250 South and 1000 West			
Total	**1,393**	**4,000**	**4,506**

In addition, the City has three inactive wells numbered #1, #2 and #4. These wells are all located at the cemetery at 1250 South 1000 West. Sand infiltrated these wells to the point where production of the wells was impaired. At that point the City did a cost analysis on relocating the water right or rehabbing the existing wells at the cemetery. It was determined that it would be less expensive to relocate the water right, and increase production capacity at the location of Well #3.

3.2.2 Level of Service and Evaluation

Typically, a system's sources are designed for peak day demand and annual average demand. This is what has been used in the analysis of the Syracuse City's sources. See Table 3-4 for a comparison of the capacity of the available sources and 2016 demands. Table 3-4 shows the

demands based on the observed data. The level of service is based on the observed demands of 0.286 gpm/ERC for peak day and 0.188 AF/Year/ERC for average annual.

Table 3-4: Existing Water Sources/Supply: Demand and Capacity

Description	gpm	af/year	Is there sufficient capacity?
Current Resources			
Existing Well # 3 (peak)	1,600	2,581	-
Existing WBWCD (peak)	2,400		
Existing WBWCD (contract)		1,925	
Total Current	**4,000**	**4,506**	
Average Annual Use			
Observed/Model – 61,161 gal/yr/ERC	899	**1,451**	yes
Peak Day Demand			
Observed/Model – 0.286 gpm/ERC[1]	**2,212**	3,568	yes
Peak Instantaneous Use			
Observed/Model – 0.429 gpm/ERC[1]	**3,318**	5,352	yes

1. Includes unmetered water.

There is sufficient capacity to meet the level of service determined by current use. However, there is not sufficient capacity to meet the level of service of 800 gpd/ ERC mandated by the State of Utah for peak day use. There is excess capacity for both the peak day and average annual water supplies based on the existing level of service. This will be detailed in a subsequent section below.

3-3 EXISTING WATER RIGHTS

3.3.1 Capacity

The State Administrative Rules for drinking water systems require that each system provide a full year supply of water to meet the demands of its users. This includes a sufficient allocation of water rights. Water rights limit the amount of water the city has a right to use to serve its users. Consequently, the city measures and records the amount of water diverted and reports that to the Division of Water Rights (Water Rights, 2014).

Syracuse City has six water rights for drinking water associated with each of the four wells. These water rights are summarized in Table 3-5. Wells 1, 2 and 4 are located in the City Cemetery, while well 3 is located at 589 West Antelope Drive. All six of the water rights have a nature of use listed as municipal. The status, status date and priority date are listed in Table 3-6 for each of the water rights. The date of when the proof of use for each non-certificated water right is due is also listed in Table 3-6. These rights all share the same points of diversion, which are the city's wells also listed in Table 3-6. Table 3-6 shows the amount of water associated with each water right. For all of the City's culinary water rights the diversion rate is

equal to the depletion rate because the rights are for municipal use. The water rights allow for a total diversion flow rate of 4.887 cfs or 2,193 gpm. Additionally, there is 5.348 cfs (2,400 gpm) available from water the City purchases from Weber Basin Water Conservancy District. Annual volumes were not listed for any of the rights except 31-3524, which is limited by 3.0 acre-feet. In conversations with the Utah State Division of Water Rights about Syracuse's water rights the State indicated that given the current water rights status, and nature of use, the annual volumes could be derived from the diversion rate based on 365 days of use, 7 days per week and 24 hours per day even in the winter. The City is still limited by the diversion rate as to how much they can use at any particular moment in time.

Table 3-5: Drinking Water Rights – Status[1]

Well #	Water Right #	Application	Status	Status Date	Priority Date	Proof Due
1	31-2207	A12548	Certificate	1/17/1951	7/26/1938	
	31-3203	U8143		3/18/1936	9/17/1934	
1, 3	**31-3996**	**A6332**	**Approved**	**8/27/1970**	**3/3/1964**	**6/30/2024**
2	31-745	A22736	Certificate	2/29/1960	4/4/1951	
3	**31-2768**	**A35934**	**Certificate**	**6/9/1983**	**3/3/1964**	
-	31-3524	A30260	Approved	5/31/2020	1890	5/31/2016
4	-	-	-	-	-	-

1. Well #3 is the only well source currently in operation.

Table 3-6: Drinking Water Rights – Quantity[1]

Well #	Water Right #	Flow (cfs)	Flow (gpm)	Flow (AF)
1	31-2207	0.21	94	152.03
	31-3203	0.35	157	253.39
1, 3	**31-3996**	**2.5**	**1,122**	**1,809.92**
2	31-745	1.30	583	941.16
3	**31-2768**	**0.50**	**224**	**361.98**
-	31-3524	0.027	12	3.0
4	-	-	-	-
Syracuse Total Water Rights		**4.887**	**2,193**	**3,521**

Weber Basin Water Conservancy District	**5.348**	**2,400**	**1,925**
Total Water Rights	**10.235**	**4,593**	**5,446**

1. Well #3 is the only well source currently in operation.

3.3.2 Level of Service and Evaluation

Typically, a system's water rights are analyzed for both peak day and average annual water available. This is what has been used in the analysis of Syracuse City's water rights. See Table 3-7 for a comparison of the demands and capacity of the available sources. Table 3-7 shows the demands based on the observed data. The level of service is based on the observed demands.

Table 3-7: Existing Water Rights: Demand and Capacity

Description	cfs	gpm	AF/yr	Is there sufficient capacity?
Current Resources				
Syracuse	4.887	2,193	3,521	-
Syracuse (Well #3 only)	3.0	1,346	2,172	
WBWCD (peak)	5.348	2,400	1,925	
Total Current (Well #3 and WBWCD Peak)	8.348	3,749	4,097	
Total Current	10.235	**4,593**	**5,446**	
Average Annual Use				
Observed/Model – 61,161 gal/yr/ERC	2.00	899	**1,451**	yes
Peak Day Demand				
Observed/Model[1] – 0.286 gpm/ERC	4.93	**2,212**	3,568	yes
Peak Instantaneous Use				
Observed/Model[1] – 0.429 gpm/ERC	7.39	**3,318**	5,352	yes

1. Includes unmetered water.

As noted in Table 3-6, not all of the city's water rights currently have points of diversion at all of the wells. It may be necessary to add points of diversion to some of the city's water rights in order to fully implement the totatl water rights shown in the "Total Current" line of Table 3-7. The Total Current (Well #3 & WBWCD peak) line shows the total water rights currently available with water rights that currently have a point of diversion at Well #3.

Points of diversion would need to be added for specific water righst through filing a change application if their intended place of use doesn't correspond with their current points of diversion in order to fully utilize the water rights in the "Total Current" line of Table 3-7.

There is sufficient capacity to meet the level of service determined by current use for the water rights. There is excess capacity for both the peak day and average annual water supplies based on the existing level of service. This will be detailed in a subsequent section below.

3-4 EXISTING WATER STORAGE

This Master Plan and Impact Fee Facilities Plan does not discuss the condition of the City's water storage facilities.

3.4.1 Capacity

Water storage provides a reserve to compensate for varying demand as a result of time of day and the season. It also provides the emergency storage needed for the large demands placed on the system as the result of firefighting efforts. The City may also elect to include a volume of water for emergency storage in the event of down time for some transmission lines or other critical system components.

Table 3-8 lists the City's existing storage reservoirs. These include 2 tanks—the 2.0 M gallon Syracuse Tank at Hill Air Force Base (HAFB) and the 1.0 M gallon Freeport Center Tank. The existing storage capacity is 3.0 million gallons. Appendix E includes copies of the contracts with HAFB and Clearfield.

The 1.0 M gallon reservoir is located directly to the eastof the City on a property to the west of the Freeport Center. It is a stand pipe tank with a height of 105 feet.

The 2.0 M gallon Syracuse Tank is owned in conjunction with Clearfield City and is connected to Clearfield's 7 M gallon tank system, which is composed of tanks that are 1.0, 2.0 and 4.0 M gallons. According to an agreement signed in 1992 by both Syracuse and Clearfield, Syracuse has,

> "the right to "peak" off Clearfield's reservoir system and to use said water lines, including those portions heretofore constructed by Clearfield and/or the Weber Basin Water Conservancy District extending from the Clearfield reservoir system to and along 1700 South to its intersection with 1000 West in Syracuse; provided, however, that its use in any month cannot exceed its calculated volumetric Weber Basin water right in said lines."

This tank is on property owned by Hill Air Force Base (HAFB). The City has a non-exclusive lease of 25 years from February 1, 1994 to January 31, 2019 for the 0.89 acre parcel of land. On this parcel of land is the two million gallon water storage tank and associated pipelines. The City leases the land from HAFB for $600 per year. Appendix E includes copies of the contracts with HAFB and Clearfield.

Clearfield City was contacted regarding their use of the 7 M gallon tank system and Syracuse's 2.0 M gallon tank. Clearfield plans to use all of the 7 M gallon tank and 2 M of Syracuse's tank for equalization and fireflow storage. Clearfield shows in their Impact Fee Facility Plan that they require 9.52 M gallons of storage for 15,962 equivalent residential connections (ERCs) and they have 12.5 M gallons of storage available. Currently, they have 14,730 ERCs. As a result, it is recommended that Syracuse only plan on use of the 3.0 M gallons of storage currently owned by Syracuse in the future and half of the 7.0 M gallon Clearfield tank system in the future because Clearfield is planning to include 100 percent of it for their own use.

Table 3-8: Existing Water Storage

Tank	Volume (Mgallons)	Elevation (feet)
Syracuse Tank at HAFB	2.0	4687 (top)
Freeport Center	1.0	4470 (top)[1]
Other-Clearfield Tank at HAFB	50%x7.0 for peak=3.5	4686[2]
Total	**6.5**	**-**

1. The elevation of the base of the tank is 4366.86 and the tank is 103 feet tall.
2. Ground elevation is 4686 and the tank is buried.

Storage can be divided into three categories.

- Equalization storage volume to satisfy peak hour demands.
- Fire storage volume to provide water for fire suppression.
- Emergency storage volume to meet emergency demands in the event of some type of system failure.

Equalization Storage –State of Utah Minimum Requirement

The equalization storage is calculated based on State of Utah minimum requirements that are listed in UAC R309-510 for indoor water uses. Outdoor use requirements and demands will be discussed in the Secondary Water Master Plan.

- Indoor Use: 400 gal/ERC X 7,730 ERCs = 3,092,000 gallons

Fire Storage –City Requirement

The State of Utah minimum fire flow is 1,000 gallons per minute for 60 minutes. The Syracuse City Fire Marshall was contacted and the City requirement is 2,000 gpm for 2 hours.

- 2,000 gpm for 2 hours = 240,000 gallons

Emergency Storage-City Requirement

This volume is determined by the City and has previously been set at 1 day of a peak day demand. This would allow some needed water while the source is cut off.

- 1 day of peak day storage: 1 day x 0.286 gpm/ERC X 7,730 ERCs = 3,185,000 gallons

All of Syracuse City has secondary water available. Outside irrigation typically accounts for more than one-half of all water used during six months of the year. Having secondary water available has a major beneficial impact on storage requirements.

3.4.2 Level of Service and Evaluation

Typically, storage facilities are designed for equalization, fire suppression and emergency storage (a portion of peak day demand). This is what has been used in the analysis of the Syracuse City's storage reservoirs. See Table 3-9 for a comparison of the demands and capacity of the available storage reservoirs. The level of service is based on the State's minimum requirements (equalization) and the City's requirements (fire and emergency).

Table 3-9: Existing Water Storage: Demand and Capacity

Description	gallons	Is there sufficient capacity?
Current Capacity/Resources		
Syracuse Tank at HAFB	2.0	-
Freeport Center	1.0	
Clearfield Tank at HAFB	50%x7,000,000 for peak=3.5	
Total Current Capacity/Resources	**6.5**	
Current Demand		
Equalization: State of Utah – 400 gal/ERC[1]	3.092	-
Fire Suppression: State of Utah – 2,000 gpm for 120 min.[2]	0.240	-
Emergency Storage: City Required – 1 day of Peak Day Storage[2]	3.185	-
Total Current Demand	**6.517**	**no, essentially capacity=demand**

1. From the Utah Administrative Code, R309-510-8 Storage Sizing: http://www.rules.utah.gov/publicat/code/r309/r309-510.htm
2. Based on Syracuse City requirements.

There is NOT sufficient capacity to meet the level of service for existing water storage even if 50% of the Clearfield 7 M gallon reservoir system is utilized. Otherwise, if none of the Clearfield 7 M gallon tank is used, the city will have an existing storage deficiency of 3.5 M gallons.

3-5 EXISTING WATER DISTRIBUTION SYSTEM

3.5.1 Condition

The distribution system includes 4, 6, 8, 10, 12 and 16-inch water lines. There is a total of 149 miles of pipelines in the City. Table 3-10 shows a breakdown of the distribution system pipelines.

Table 3-10: Distribution System Breakdown

Size (inch)	Length (LF)	Length (Miles)	Type	Age
4	4,538	0.859	PVC C-900, DR 18; cast iron	1993 to 2008
6	49,067	9.29	PVC C-900, DR 18; Class 200; PVC C-900, DR 14; poly; cast iron; AC; Class 200 SDR-26; ductile iron	1966 to 2008
8	450,291	85.3	PVC C-900, DR 18; Class 200; PVC C-900, DR 14; cast iron	1966 to 2015
10	60,410	11.4	PVC C-900, DR 18; Class 200; PVC C-900, DR 14; Class 200 SDR-26; DI; cast iron	1973-2015
12	92,454	17.5	PVC C-900, DR 18; PVC C-900, DR 14; Class 200; DI	1992-2014
16	10,683	2.02	PVC C-900, DR 18; DI	2008-2013
-	120,749	22.9	unknown	
Total	**788,193**	**149**	**-**	**-**

The older portions of the system (1966 through the mid-1980s) are smaller in diameter and are generally composed of cast iron (CI), ductile iron (DI) or Class 200 pipe (See Table 3-10). There was 55,804 feet of pipe that was installed between the 1960s through the 1980s (See Table 3-11). The size of the older pipes are 6, 8 and 10 inches. More than 69 percent of the distribution system has been installed since the 1990s. The design life for pipe is typically 50 years.

Table 3-11: Distribution System Age

Age	Sizes	Length (LF)	Length (Miles)	Percent of Total
>1970	6, 8	12,303	2.33	1.6%
1970s	6, 8, 10	33,000	6.25	4.2%
1980s	6, 8, 10	10,500	1.99	1.3%
1990s	4, 6, 8, 10, 12	234,798	44.5	30%
2000s	4, 6, 8, 10	218,437	41.4	28%
2010s	4, 6, 8, 10, 12, 16	89,566	17.0	11%
not reported	-	189,589	35.9	24%
Total	**-**	**788,193**	**149**	**-**

3.5.2 Modeling

The hydraulic model for Syracuse City was built in Innovyse's water modeling software called infowater. The model uses data for tanks, prv's, pipes, valves, and pumps to calculate pressures throughout the system. The demands were calculated from water meter records and then loaded into the model (see section 3-1). Information about pipes, tanks, prv's and pumps were provided by Syracuse City in GIS format and loaded into the model. The model was used to analyze peak day, peak day plus fireflow, and peak instantaneous scenarios. These same scenarios were analyzed for existing conditions, future 2026, and buildout conditions. The pressures calculated in the model were then used to verify compliance with the State of Utah guidelines for minimum pressures; peak day>40 psi, peak instantaneous>30 psi and peak day plus fireflow>20 psi. The model was used to identify existing deficiencies as well as future deficiencies and the needed solutions to fix the deficiencies.

3.5.3 Level of Service and Evaluation

The distribution system level of service is based upon a review of fire flow demands for various areas and structures and comparing these to the Utah State minimum requirements as well as the capacity of the system. Target fire flows were assumed based upon input from the fire marshal and previous master plans. A fire flow analysis was performed in the model near large water users and such places as schools, churches, and commercial areas. This analyses was performed using a peak day demand in addition to the fire flow demand.

The State of Utah requires that hydraulic models apply either an instantaneous peaking factor to account for peak instantaneous demand or use actual peak instantaneous water flow data (see UAC R309-510). Because of the absence of actual instantaneous water flow data a peaking factor of 1.5 times the peak day demand was used. Thus, the peak instantaneous demand is 0.429 gpm/ERC.

Required fire flows included 1,000 gpm for established residential areas and for new residential developments. Fire flows for the five largest entities, such as commercial and institutional facilities, are as follows:

- US Cold Storage, 4,000 gpm
- Syracuse High School, 4,000 gpm
- RC Wiley, 4,000 gpm
- Smith's, 3,000 gpm
- Walmart, 4,000 gpm

The State of Utah (see UAC R309-510) requires that the distribution system pressure be greater than 40 psi during peak day demand, greater than 30 psi during peak instantaneous (hour) demand and greater than 20 psi during peak day demand with fire flow demand. As part of the City's Culinary Water Master Plan, the existing water model of the distribution system was updated. The water model was developed using Innovyze's InfoWater product. Figure 3-2 in Appendix B shows the available pressure at each node for existing peak day flows. There are no nodes that have pressures less than 40 psi. Figure 3-3 in Appendix B shows the pressure available at each node during existing peak day flows with fire flows. There are no nodes where

the estimated fire flow is less than 20 psi . Table 3-12 shows the minimum pressure requirement at each of the demand conditions.

Table 3-12: Existing Water Distribution System: Demand and Capacity

Description	Zone 1	Zone 2	Is there sufficient capacity?
Minimum Pressure: State of Utah Requirements[1]			
During Peak Day Demand	40	40	yes
During Peak Instantaneous Demand	30	30	yes
Minimum Pressure During Peak Day and Fire Flow Demand	20	20	no

1. From the Utah Administrative Code, R309-510-9 Distribution System Sizing and R309-105-9 Minimum Water Pressure: http://www.rules.utah.gov/publicat/code/r309/r309-510.htm

The existing distribution system in Syracuse City is generally in good shape and can handle the modeled flows. There are a few nodes that do not meet the 20 psi minimum pressure. The pipine line from the Freeport water tank needs to be upsized from a 10" diameter pipe to a 16" diameter pipe. This is the only existing deficiency identified. It is assumed that the minimum pipe size for all new developments is 8-inch diameter. Certain developments with large water users may require the installation of pipes larger than the 8-inch diameter standard for the required fire or demand flow. It is recommended that this aspect be considered on a case-by-case basis as new development is planned and reviewed. Since the modeling does not show deficiencies, if a large water user requires pipe upsizing for that specific development, this cost shall be borne by the developer.

There is sufficient capacity based on pressure and flow to meet the level of service for the water distribution system.

4 – FUTURE SYSTEM EVALUATION

The future service area includes both the city boundary and the future annexation area (Syracuse, 2015). Syracuse City anticipates that the boundaries of the city will increase over time as demand for growth increases (Syracuse, 2014). The future service area is estimated based upon the land use classifications (density) and boundaries established by the City's General Plan. Much of the surrounding undeveloped land is unincorporated and is not adjacent to neighboring municipalities. Future demands on the system will occur in sections of the City already developed, in currently undeveloped areas of the city, and in the future annexation areas. Future demands on the water system have been estimated based upon the land use classifications established by the City's General Plan (Syracuse City, 2015). It is expected that changes will occur over time to both the service boundaries and land densities (Syracuse City, 2014). However, this analysis is based on what is currently adopted and master planned for future development (Syracuse City, 2015). As such, changes to this plan may be necessary as growth proceeds (Syracuse City, 2014). All areas of future demand were assumed to have secondary pressure irrigation available. Appendix B contains a map, Figure 4-1, showing the future service area and the proposed water system improvements to serve the future service area.

4-1 FUTURE DEMANDS AND LEVEL OF SERVICE

The future demand was calculated to determine deficiencies in the City's water system. Then, the future demand was input into the water model and various scenarios of flow conditions were evaluated. From these scenarios, areas of low pressure or flow (deficiencies) can be determined.

The future demands are a function of the existing population and ERCs. Chapter 2 above provides more detail on the population and ERCs.

For the model it was assumed that all of the connections had secondary water available for outdoor uses. For planning purposes, it is assumed that all new growth will use secondary water for irrigation.

The assumption has been made that future demand characteristics will be similar to current patterns for similar land uses. Therefore, the existing level of service will be the same level of service for the future for the water sources, storage and distribution system. Table 4-1 summarizes the level of service and future demands for the source, storage and distribution system.

Table 4-1: Summary of Level of Service and Demands

		Year 2016	Year 2026	Build-out/2038
	Required/ERC	**7,730 ERCs**	**10,886 ERCs**	**14,732 ERCs**
Water Source	412 gpd/ERC-peak day	2,212 gpm	3,115 gpm	4,215 gpm
Water Rights	0.188 af-yr/ERC-average annual	1,451 af/yr	2,043 af/yr	2,765 af/yr
Water Storage	843 gal/ERC-peak day	6.52 Mgal	9.08 Mgal	12.02 Mgal
Water Distribution	Minimum Fire Flow with Peak Day at 20 psi	1,764 gpm	1,445 gpm	1,722 gpm[1]

1. The increase in fire flow from 2026 to 2038 is a result of looping a new development on the north end of the City.

4-2 FUTURE WATER SOURCES / SUPPLY AND WATER RIGHTS

Based upon current growth rates for Syracuse and the State's guidelines for supply, the existing sources will be adequate for several more years. This assumes that the production of the existing well can be increased to allow the City to continue to "use it for some peaking." The main source of supply will continue to be water from Weber Basin Water Conservancy District.

The water requirement was analyzed in two different aspects. The first is on a flow rate or diversion basis. This diversion rate is the rate at which water must be supplied to meet the peak day demand (in gpm or cfs). The second approach looks at the volume of water needed for the annual projected use (in ac-ft/yr). Table 4-2 shows the peak day demand and Table 4-3 show the annual projected water use versus the water supply. Tables 4-4 and 4-5 show the peak day and average annual demands compared to the water rights diversion rate. In all of the tables the right hand column shows the excess capacity or deficiency for the system and the year that that occurs. It should be noted that the annual projected water volume in Table 4-3, is a yearly average. Demand will be slightly higher during peak events, and so a greater volume of water than the yearly average will be required.

Both the peak day and annual average demands were calculated based on the projected number of ERCs. ERC-based projections have been created to determine approximately when the existing sources and water rights diversion rate will be exceeded based upon both a peak day and an annual use or volume basis. Total future water demand at build out was estimated to be 4,215 gpm for peak day in the year 2038.

Table 4-2: Peak Day Source Water Supply Assessment for Planning Period

Demand Category				Peak Day Demand (gpm)[3]	Supply (gpm)			Excess Capacity (gpm)
Year[1]	Res. ERCs	Non Res - ERCs	Total ERCs[2]		Well #3[4]	WBWCD	Total Supply	
2016	7,420	310	7,730	2,212	1,600	2,400	4,000	1,788
2017	7,694	315	8,009	2,292	1,600	2,400	4,000	1,708
2018	8,009	319	8,328	2,383	1,600	2,400	4,000	1,617
2019	8,324	324	8,648	2,474	1,600	2,400	4,000	1,526
2020	8,638	329	8,967	2,566	1,600	2,400	4,000	1,434
2021	8,953	334	9,287	2,657	1,600	2,400	4,000	1,343
2022	9,268	339	9,607	2,749	1,600	2,400	4,000	1,251
2023	9,583	344	9,926	2,840	1,600	2,400	4,000	1,160
2024	9,897	349	10,246	2,932	1,600	2,400	4,000	1,068
2025	10,212	354	10,566	3,023	1,600	2,400	4,000	977
2026	10,527	359	10,886	3,115	1,600	2,400	4,000	885
2027	10,841	365	11,206	3,206	1,600	2,400	4,000	794
2028	11,156	370	11,526	3,298	1,600	2,400	4,000	702
2029	11,471	376	11,847	3,390	1,600	2,400	4,000	610
2030	11,786	381	12,167	3,481	1,600	2,400	4,000	519
2031	12,100	387	12,487	3,573	1,600	2,400	4,000	427
2032	12,415	393	12,808	3,665	1,600	2,400	4,000	335
2033	12,730	399	13,128	3,756	1,600	2,400	4,000	244
2034	13,044	405	13,449	3,848	1,600	2,400	4,000	152
2035	13,359	411	13,770	3,940	1,600	2,400	4,000	60
2036	13,674	417	14,091	4,032	1,600	2,400	4,000	-32
2037	13,989	423	14,411	4,123	1,600	2,400	4,000	-123
2038	14,303	429	14,732	4,215	1,600	2,400	4,000	-215

1. Build-out is assumed to occur in 2038. See Chapter 2 for more discussion on this.

2. Chapter 2 details more information on the residential growth rate, which decreases from 4.7% to 1.9% as build-out is approached, and the non-residential growth rate of 1.49%.
3. The peak day demand is based on historic use of 0.286 gpm/ERC. This is 52% of the State peak day demand of 0.56 gpm/ERC.
4. The initial well supply is 500 gpm and it increases to 1600 gpm to address increasing demand.

Table 4-3: Annual Average Source Water Supply Assessment for Planning Period

Demand Category				Daily Demand (AF)[3]	Supply (AF)			Excess Capacity (AF)
Year[1]	Res. ERCs	Non Res - ERCs	Total ERCs[2]		Well #3	WBWCD	Total Supply	
2016	7,420	310	7,730	1,451	2,581	1,925	4,506	3,055
2017	7,694	315	8,009	1,503	2,581	1,925	4,506	3,003
2018	8,009	319	8,328	1,563	2,581	1,925	4,506	2,943
2019	8,324	324	8,648	1,623	2,581	1,925	4,506	2,883
2020	8,638	329	8,967	1,683	2,581	1,925	4,506	2,823
2021	8,953	334	9,287	1,743	2,581	1,925	4,506	2,763
2022	9,268	339	9,607	1,803	2,581	1,925	4,506	2,703
2023	9,583	344	9,926	1,863	2,581	1,925	4,506	2,643
2024	9,897	349	10,246	1,923	2,581	1,925	4,506	2,583
2025	10,212	354	10,566	1,983	2,581	1,925	4,506	2,523
2026	10,527	359	10,886	2,043	2,581	1,925	4,506	2,463
2027	10,841	365	11,206	2,104	2,581	1,925	4,506	2,402
2028	11,156	370	11,526	2,164	2,581	1,925	4,506	2,342
2029	11,471	376	11,847	2,224	2,581	1,925	4,506	2,282
2030	11,786	381	12,167	2,284	2,581	1,925	4,506	2,222
2031	12,100	387	12,487	2,344	2,581	1,925	4,506	2,162
2032	12,415	393	12,808	2,404	2,581	1,925	4,506	2,102
2033	12,730	399	13,128	2,464	2,581	1,925	4,506	2,042
2034	13,044	405	13,449	2,525	2,581	1,925	4,506	1,981
2035	13,359	411	13,770	2,585	2,581	1,925	4,506	1,921
2036	13,674	417	14,091	2,645	2,581	1,925	4,506	1,861

2037	13,989	423	14,411	2,705	2,581	1,925	4,506	1,801
2038	14,303	429	14,732	2,765	2,581	1,925	4,506	1,741

1. Build-out is assumed to occur in 2038. See Chapter 2 for more discussion on this.
2. Chapter 2 details more information on the residential growth rate, which decreases from 4.7% to 1.9% as build-out is approached, and the non-residential growth rate of 1.49%.
3. The average annual demand is based on historic use of 0.188 acre-feet/year/ERC (61,161 gallons/year/ERC). This is 42% of the State average yearly demand of 146,000 gallons/year/ERC.

Table 4-4: Peak Diversion Water Right Assessment for Planning Period

Demand Category				Demands		Supply			Excess Capacity (cfs)
Year[1]	Res. ERCs	Non Res - ERCs	Total ERCs[2]	Peak Day Demand (gpm)[3]	Peak Daily Demand (cfs)	Syracuse Water Rights (cfs)[4]	Weber Basin WCD Water Rights (cfs)[4]	Total Water Rights Diversion Rate (cfs)[4]	
2016	7,420	310	7,730	2,212	4.93	4.887	5.348	10.235	5.31
2017	7,694	315	8,009	2,292	5.11	4.887	5.348	10.235	5.13
2018	8,009	319	8,328	2,383	5.31	4.887	5.348	10.235	4.93
2019	8,324	324	8,648	2,474	5.51	4.887	5.348	10.235	4.72
2020	8,638	329	8,967	2,566	5.72	4.887	5.348	10.235	4.52
2021	8,953	334	9,287	2,657	5.92	4.887	5.348	10.235	4.31
2022	9,268	339	9,607	2,749	6.12	4.887	5.348	10.235	4.11
2023	9,583	344	9,926	2,840	6.33	4.887	5.348	10.235	3.91
2024	9,897	349	10,246	2,932	6.53	4.887	5.348	10.235	3.70
2025	10,212	354	10,566	3,023	6.74	4.887	5.348	10.235	3.50
2026	10,527	359	10,886	3,115	6.94	4.887	5.348	10.235	3.29
2027	10,841	365	11,206	3,206	7.14	4.887	5.348	10.235	3.09
2028	11,156	370	11,526	3,298	7.35	4.887	5.348	10.235	2.89
2029	11,471	376	11,847	3,390	7.55	4.887	5.348	10.235	2.68
2030	11,786	381	12,167	3,481	7.76	4.887	5.348	10.235	2.48
2031	12,100	387	12,487	3,573	7.96	4.887	5.348	10.235	2.27
2032	12,415	393	12,808	3,665	8.17	4.887	5.348	10.235	2.07

2033	12,730	399	13,128	3,756	8.37	4.887	5.348	10.235	1.86
2034	13,044	405	13,449	3,848	8.57	4.887	5.348	10.235	1.66
2035	13,359	411	13,770	3,940	8.78	4.887	5.348	10.235	1.46
2036	13,674	417	14,091	4,032	8.98	4.887	5.348	10.235	1.25
2037	13,989	423	14,411	4,123	9.19	4.887	5.348	10.235	1.05
2038	14,303	429	14,732	4,215	9.39	4.887	5.348	10.235	0.84

1. Build-out is assumed to occur in 2038. See Chapter 2 for more discussion on this.
2. Chapter 2 details more information on the residential growth rate, which decreases from 4.7% to 1.9% as build-out is approached, and the non-residential growth rate of 1.49%.
3. The peak day demand is based on historic use of 0.286 gpm/ERC. This is 52% of the State peak day demand of 0.56 gpm/ERC.
4. See Chapter 3 for an assessment of the water rights, diversion rates, and points of diversion.

Table 4-5: Annual Water Right Assessment for Planning Period

Demand Category				Demands		Water Rights (AF/yr)			Excess Rights (AF/yr)
Year[1]	Res. ERCs	Non Res - ERCs	Total ERCs[2]	Daily Demand (gpm)[3]	Annual Demand (AF/yr)	Syracuse Water Rights (AF/yr)	Weber River WCD (AF/yr)	Total Rights (AF/yr)[4]	
2016	7,420	310	7,730	899	1,451	3,521	1,925	5,446	3,995
2017	7,694	315	8,009	932	1,503	3,521	1,925	5,446	3,943
2018	8,009	319	8,328	969	1,563	3,521	1,925	5,446	3,883
2019	8,324	324	8,648	1,006	1,623	3,521	1,925	5,446	3,823
2020	8,638	329	8,967	1,043	1,683	3,521	1,925	5,446	3,763
2021	8,953	334	9,287	1,081	1,743	3,521	1,925	5,446	3,703
2022	9,268	339	9,607	1,118	1,803	3,521	1,925	5,446	3,643
2023	9,583	344	9,926	1,155	1,863	3,521	1,925	5,446	3,583
2024	9,897	349	10,246	1,192	1,923	3,521	1,925	5,446	3,523
2025	10,212	354	10,566	1,230	1,983	3,521	1,925	5,446	3,463
2026	10,527	359	10,886	1,267	2,043	3,521	1,925	5,446	3,403
2027	10,841	365	11,206	1,304	2,104	3,521	1,925	5,446	3,343
2028	11,156	370	11,526	1,341	2,164	3,521	1,925	5,446	3,283

2029	11,471	376	11,847	1,379	2,224	3,521	1,925	5,446	3,223
2030	11,786	381	12,167	1,416	2,284	3,521	1,925	5,446	3,163
2031	12,100	387	12,487	1,453	2,344	3,521	1,925	5,446	3,102
2032	12,415	393	12,808	1,490	2,404	3,521	1,925	5,446	3,042
2033	12,730	399	13,128	1,528	2,464	3,521	1,925	5,446	2,982
2034	13,044	405	13,449	1,565	2,525	3,521	1,925	5,446	2,922
2035	13,359	411	13,770	1,602	2,585	3,521	1,925	5,446	2,862
2036	13,674	417	14,091	1,640	2,645	3,521	1,925	5,446	2,802
2037	13,989	423	14,411	1,677	2,705	3,521	1,925	5,446	2,741
2038	14,303	429	14,732	1,714	2,765	3,521	1,925	5,446	2,681

1. Build-out is assumed to occur in 2038. See Chapter 2 for more discussion on this.
2. Chapter 2 details more information on the residential growth rate, which decreases from 4.7% to 1.9% as build-out is approached, and the non-residential growth rate of 1.49%.
3. The average annual demand is based on historic use of 0.188 acre-feet/year/ERC (61,161 gallons/year/ERC). This is 42% of the State average yearly demand of 146,000 gallons/year/ERC.
4. See Chapter 3 for an assessment of the water rights, diversion rates, and points of diversion.

Table 4-2 indicates that the City's well will need to increase in production to 1,600 gpm, which is the maximum production of the well, around 2034 to address increased peak day demand. The maximum well production number of 1,600 gpm was provided by the City based upon tests when the well was put into production. In 2036 the peak day demand will exceed both the maximum well capacity and the WBWCD contracted water amount. The level of service for the peak day demand was calculated based on actual observed use and not the State source sizing requirements. The level of service for the peak day demand is 0.286 gpm/ERC, which includes unmetered water (leaks, and etc.). Since the actual use is 52% of the State's peak day demand use, if the State's sizing requirements were used the system would already be at capacity and new water would be needed immediately even with the well at maximum production.

Table 4-3 indicates that the City's water supply, well #3, and the contracted water from WBWCD, are sufficient to address the future annual average demand needs based on the level of service discussed in section 3.2.2. The level of service is 0.188 acre-feet/year/ERC or 61,161 gallons/year/ERC.

Table 4-4 compares the peak day diversion rates to the available water rights. As noted previously the diversion rate is equal to the depletion rate. After discussion with the Utah Division of Water Rights, annual volumes were calculated based on 365 days of use for 7 days per week and 24 hours per day even in winter. Based on the level of service for the water source of 0.286 gpm/ERC, there is sufficient peak day diversion rate total water rights supply to meet the peak day demand. However, the City will need to change the point of diversion for more of the water rights, perhaps 31-0745, in order to be able to use the full capacity from the well (1,600 gpm) no later than 2032. Currently the water rights on well #3 well are limited by 3.0 cfs (1,346 gpm) because it is the point of diversion for only two water rights: 31-2768 and 31-3996. Also, the City will want to have their approved water rights certificated (31-3524 and 31-3996) before the proofs are due. The City should also work to acquire additional water rights from developers or others as the city continues to develop and add ERCs.

Table 4-5 indicates that the annual water rights are sufficient through build-out.

4-3 FUTURE WATER STORAGE

Along with the existing storage assumptions discussed in the previous section, future storage requirements are determined based on the assumptions listed below:

- Secondary water will be available in newly developed areas.
- Most of the new development will be residential areas, so the typical residential demand currently experienced for a connection with secondary water has been applied for undeveloped areas.
- The level of service is based on the State minimum guidelines.

The State of Utah has minimum guidelines for establishing equalization and fire flow storage volumes. Typically, cities determine necessary emergency storage. The level of service for

storage is based on 400 gallons/ERC for equalization, 2,000 gpm for 2 hours for fire storage and 1 day of peak day flow for emergency storage.

Table 4-6 shows the storage assessment. The available storage includes the city's two tanks (2.0 Mgal Clearfield and 1.0 Mgal Freeport Center) as well as the assumption that half of the 7.0 Mgal Clearfield tank system (3.5 Mgal), which is owned by Clearfield, but is available for Syracuse to use for "peaking."

Table 4-6: Storage Assessment for Planning Period

Demand Category				Storage Needs (Million Gallons)				Storage Available (Million Gallons)				Excess Storage (Mgal)
Year[1]	Res. ERCs	Non Res - ERCs	Total ERCs[2]	EQ	Fire	Emer-gency	Total Storage Needs[3]	Clearfield Tank at HAFB	Freeport Center	Clearfield (Peak Only)	Total	
2016	7,420	310	7,730	3.092	0.240	3.185	6.517	2.0	1.0	3.5	6.5	-0.02
2017	7,694	315	8,009	3.20	0.24	3.30	6.74	2.0	1.0	3.5	6.5	-0.24
2018	8,009	319	8,328	3.33	0.24	3.43	7.00	2.0	1.0	3.5	6.5	-0.50
2019	8,324	324	8,648	3.46	0.24	3.56	7.26	2.0	1.0	3.5	6.5	-0.76
2020	8,638	329	8,967	3.59	0.24	3.69	7.52	2.0	1.0	3.5	6.5	-1.02
2021	8,953	334	9,287	3.71	0.24	3.83	7.78	2.0	1.0	3.5	6.5	-1.28
2022	9,268	339	9,607	3.84	0.24	3.96	8.04	2.0	1.0	3.5	6.5	-1.54
2023	9,583	344	9,926	3.97	0.24	4.09	8.30	2.0	1.0	3.5	6.5	-1.80
2024	9,897	349	10,246	4.10	0.24	4.22	8.56	2.0	1.0	3.5	6.5	-2.06
2025	10,212	354	10,566	4.23	0.24	4.35	8.82	2.0	1.0	3.5	6.5	-2.32
2026	10,527	359	10,886	4.35	0.24	4.49	9.08	2.0	1.0	3.5	6.5	-2.58
2027	10,841	365	11,206	4.48	0.24	4.62	9.34	2.0	1.0	3.5	6.5	-2.84
2028	11,156	370	11,526	4.61	0.24	4.75	9.60	2.0	1.0	3.5	6.5	-3.10
2029	11,471	376	11,847	4.74	0.24	4.88	9.86	2.0	1.0	3.5	6.5	-3.36
2030	11,786	381	12,167	4.87	0.24	5.01	10.12	2.0	1.0	3.5	6.5	-3.62
2031	12,100	387	12,487	4.99	0.24	5.14	10.38	2.0	1.0	3.5	6.5	-3.88
2032	12,415	393	12,808	5.12	0.24	5.28	10.64	2.0	1.0	3.5	6.5	-4.14
2033	12,730	399	13,128	5.25	0.24	5.41	10.90	2.0	1.0	3.5	6.5	-4.40
2034	13,044	405	13,449	5.38	0.24	5.54	11.16	2.0	1.0	3.5	6.5	-4.66
2035	13,359	411	13,770	5.51	0.24	5.67	11.42	2.0	1.0	3.5	6.5	-4.92
2036	13,674	417	14,091	5.64	0.24	5.81	11.68	2.0	1.0	3.5	6.5	-5.18
2037	13,989	423	14,411	5.76	0.24	5.94	11.94	2.0	1.0	3.5	6.5	-5.44
2038	14,303	429	14,732	5.89	0.24	6.07	12.20	2.0	1.0	3.5	6.5	-5.70

1. Build-out is assumed to occur in 2038. See Chapter 2 for more discussion on this.

2. Chapter 2 details more information on the residential growth rate, which decreases from 4.7% to 1.9% as build-out is approached, and the non-residential growth rate of 1.49%.
3. The storage requirements are based on the State minimum guidelines of 400 gal/ERC for equalization and the City requirement of 2,000 gpm for 2 hours for fire flow. The emergency storage is based on 1 day of peak day demand, which is 0.286 gpm/ERC.

The storage assessment indicates that storage is currently satisfied, however more will be required in the future as the city continues to grow in order to meet the level of service. By build-out, 2038, the storage deficiency is expected to be nearly 6.0 M gallons.

4-4 FUTURE WATER DISTRIBUTION SYSTEM

Areas of future development have been modeled based on future projected demands and assumed pipe locations. It is anticipated that 8" waterlines will be installed to serve future developments unless otherwise noted. A summary of the model results using the level of service based on peak day demands and fire flow demands established in Chapter 2 is included in Appendix C. The Table in Appendix C compares the pressure for a particular node at the 2016, 2026 and 2038 peak day demand plus fire flow demand. The comparison indicates that there are no nodes with pressure less than 20 psi at the fire flow demand plus peak day demand. Model runs for the existing condition include all improvements listed under "Existing Deficiencies", while model runs for the future condition include all improvements listed under "Future Deficiencies," which include 2026 (10 year) and 2038 (build-out) improvements. See Figures 4-2 and 4-3 in Appendix B that show the peak day and peak day with fire flow system pressures.

A review of the data from the model runs indicate that there is sufficient capacity based on pressure and flow to meet the level of service for the water distribution system.

5 - SYSTEM DEFICIENCIES AND RESERVE CAPACITY

There are no deficiencies in the existing system based on the City's level of service for water supply, water rights, water storage, and the water distribution system. Although, it is noted that the existing water storage demand is equal to the water storage supply.

Future deficiencies are defined as those improvements required to maintain established levels of service at build-out. Of course the difficulty lies in determining the timing of needed improvements. Typically, the improvements are needed some time prior to build out. In the future the supply (peak day) and storage are deficient. Both the water rights--peak day supply and annual volume are sufficient as is the future annual average supply. However, the City will need to change the point of diversion on some of their existing wells to ensure there are sufficient water rights as the pump output is increased to match demand. The distribution system also has sufficient capacity through build-out.

Syracuse has experienced remarkable growth since 2000, but there are still sections of undeveloped land in the City. The existing and build-out conditions were modeled. The construction sequence of the future deficiency projects will depend upon where development occurs. Development trends and rates will have an impact on where improvements are needed and when.

5-1 WATER SOURCES / SUPPLY AND WATER RIGHTS

The capacity of the water sources are 1,600 gpm from well #3 and 2,400 gpm from WBWCD (contract is for 1,925 af/yr). As stated earlier the peak day supply has reserve capacity through 2035, and is deficient from 2036 through build-out as shown in Table 5-1. The annual water supply has reserve capacity through build-out as shown in Table 5-2.

Table 5-1: Peak Day Water Sources Excess Capacity/Deficiency

Year	ERCs	Demand (gpm)	Excess Capacity/ Deficiency (gpm)	Excess Capacity/ Deficiency (%)
Capacity	13,980	4,000	-	-
2016	7,730	2,212	1,788	45
2026	10,886	3,115	885	22
Build-out/2038	14,732	4,215	-215	-5

Table 5-2: Average Annual Water Sources Excess Capacity/Deficiency

Year	ERCs	Demand (AF/yr)	Excess Capacity/ Deficiency (AF/yr)	Excess Capacity/ Deficiency (%)
Capacity	24,005	4,506	-	-
2016	7,730	1,451	3,055	68
2026	10,886	2,043	2,463	55
Build-out/2038	14,732	2,765	1,741	39

The total water rights peak day diversion rates have reserve capacity through build-out as shown in Table 5-3. The City will need to change the point of diversion on many of these rights to well #3 to facilitate operating the pump at maximum output. While the points of diversion should be able to be changed it is possible that some could prove difficult to change. Thus, the excess capacity is only an apparent total excess capacity and not the actual. The average annual water rights volumes have reserve capacity through build-out and should also be seen as the apparent total excess capacity and not the actual as shown in Table 5-4.

Table 5-3: Peak Day Water Rights Excess Capacity/Deficiency

Year	ERCs	Demand (cfs)	Excess Capacity/ Deficiency (cfs)	Excess Capacity/ Deficiency (%)
Capacity	16,054	10.235	-	-
2016	7,730	4.93	5.31	52
2026	10,886	6.94	3.29	32
Build-out/2038	14,732	9.39	0.84	8

Table 5-4: Average Annual Water Rights Excess Capacity/Deficiency

Year	ERCs	Demand (AF/yr)	Excess Capacity/ Deficiency (AF/yr)	Excess Capacity/ Deficiency (%)
Capacity	29,015	5,446	-	-
2016	7,730	1,451	3,995	73
2026	10,886	2,043	3,403	62
Build-out/2038	14,732	2,765	2,681	49

5-2 WATER STORAGE

The capacity of the water storage tanks is 3.0 Mgal. In addition, the City is allowed to use the 7.0 Mgal Clearfield Storage Tank for "peaking". Although, the City is only assuming use of 50% of this storage (3.5 Mgal). While the existing system is slightly undersized for the level of

service, the future system is deficient to provide storage through build-out as shown in Table 5-5.

Table 5-5: Water Storage Excess Capacity/Deficiency

Year	ERCs	Demand (Mgal)	Excess Capacity/ Deficiency (Mgal)	Excess Capacity/ Deficiency (%)
Capacity	7,709	6.50	-	-
2016	7,730	6.52	-0.02	0
2026	10,886	9.08	-2.58	-40
Build-out/2037	14,732	12.20	-5.70	-88

5-3 WATER DISTRIBUTION

An analysis was done to determine the capacity in the transmission and distribution lines that are over 8 inches in diameter. The existing peak hour flow rate in the pipeline was compared to the maximum permissible flow in the pipeline. The maximum permissible flow was established as at a velocity of 5 feet/second for the purposes of this analysis (AWWA, 2005). So, the resulting diameter at 5 feet/second was compared to the actual diameter of the pipeline. The result is the size differential. Then, a "diameter difference" was assigned for every 2-inch difference based on the following intervals: greater than 10-inch equals 5 diameter, greater than 8-inch equals 4 diameter, greater than 6-inch equals 3 diameter, greater than 3-inch equals 2 diameter and greater than 2-inch equals 1 diameter. For example, a "five diameter" difference means that there are five pipe sizes between the actual and the minimum required diameter (calculated at 5 feet per second)—that is 16-inch, 14-inch, 12-inch, 10-inch and 8-inch. The "diameter difference" indicates the excess capacity in the pipeline.

Table 5-6 shows the excess capacity in the waterlines organized by the diameter larger than required for the year 2016. Excess capacity for the years 2026 and build-out was not determined.

Table 5-6: Water Distribution Excess Capacity -Year 2016

Diameter Difference	Diameter of Pipelines Affected (inches)	Number of Pipelines	Length of Pipelines (feet)	% of the Total Length
Five	12 and 16"	35	21,784	4
Four	10, 12 and 16"	107	72,326	12%
Three	8, 10, 12 and 16"	942	406,424	67%
Two	8, 12 and 16"	223	102,369	17%

1. The "diameter difference" was assigned for every 2-inch difference based on the following intervals: greater than 10-inch equals 5 diameter, greater than 8-inch equals 4 diameter, greater than 6-inch equals 3 diameter and greater than 3-inch equals two diameter and greater than 2-inch equals one diameter. For example, a "five diameter" difference means that there are five pipe sizes between the actual and the minimum required diameter (calculated at 5 feet per second)—that is 16-inch, 14-inch, 12-inch, 10-inch and 8-inch.

5-4 COST OF EXCESS CAPACITY

The cost of the excess capacity for 2016 is not included. The City did not have the data (years of installation and year of installation construction costs) of the costs for the source, water rights, storage and distribution.

6 - PROJECTS TO ADDRESS DEFICIENCIES

6-1 PROJECTS TO ADDRESS EXISTING SYSTEM DEFICIENCIES

6.1.1 Water Sources / Supply and Water Rights

None required.

6.1.2 Water Storage

None required.

6.1.3 Water Distribution System

None required.

6-2 PROJECTS TO ADDRESS FUTURE SYSTEM DEFICIENCIES AND GROWTH

6.2.1 Water Sources / Supply and Water Rights

This City will need to apply for a reduction in sizing criteria from the State Division of Drinking Water. See section 3.1.2 for more information.

The City shall plan to review and renew contracts for water with WBWCD, if necessary.

To address the deficiency in the peak day supply either a new well should be constructed, which would allow the City use of its underutilized water rights, or an additional contract with WBWCD should be negotiated for additional culinary water. WBWCD has contacted their clientele and has informed them that each city will have to find alternative sources of water as they will not be able to meet all the future demands. WBWCD's water will continue to increase in cost to meet future needs incurred by operating their water treatment plants and developing harder to access water supplies.

A new well is the recommended method to meet the water demands of the City at build-out conditions. It is recommended that these facilities be constructed within the City limits. It is recommended that the City re-evaluate demands and the source supply as build-out approaches.

Regarding water rights, currently the City has an adequate diversion rate to meet the peak day demand and an adequate yearly volume of water supplied to meet the annual projected use. Both the approved, but not-yet-certificated water rights, 31-3524 and 31-3996, must be certificated or their approval extended beyond the 50-year approval date. This water will be needed as future development occurs. As the water demands increase in the future, the city may choose to provide proof of beneficial use of the water and request that the water become

certificated. Also, the City will need to initiate a change in the point of diversion for some of the water rights to associate more water rights with well #3 as the output of the well increases to keep up with increasing demand. This is expected to be required by 2032 when the output of well #3 will increase beyond the 3.0 cfs water right associated with well #3.

6.2.2 Water Storage

The City should plan to renew contracts for water storage with HAFB and Clearfield. The contract for use of the land at HAFB expires in 2019.

It is recommended that Syracuse City begin planning for an additional water storage facility to address the storage deficiency that is currently occurring. The water storage shortfall at build-out is projected to be 5.70 Mgal.

The City also has plans to convert their existing 1.0 Mgal tank to their secondary system which would further reduce the total culinary water storage volume. A minimum of 4.0 Mgal of additional storage is needed to address the shortfall in year 2026 of 2.58 Mgal + the 1.0 Mgal loss of the existing culinary water tank, for a total of 3.58 Mgal.

When the existing 1 MG tank at the Freeport Center is converted to the secondary water system, Syracuse City should then build a new 2 MG water tank in place of the existing secondary water tower. The City already has plans to use $1 M in existing impact fees to construct the new storage tank.

To address future water storage deficiencies, the City plans to jointly build a tank(s) with Weber Basin Water Conservancy District (WBWCD). WBWCD would like to build the tank at HAFB, which would also require upsizing the existing transmission line to convey water to Syracuse. The District and Syracuse City have explored constructing 8 M gallons of storage—4 Mgal in the near term and another 4 Mgal approaching build-out. Syracuse City would claim ownership of 5 MG of the new HAFB Storage. Costs associated with adding storage are included in Chapter 6.

6.2.3 Water Distribution System

A transmission line will need to be added to convey the extra water from the shared storage tank at HAFB. This cost will be shared with WBWCD.

Development is typically required to provide and install water distribution facilities consisting of mostly 8-inch diameter pipelines. There are also improvements that will be the responsibility of Syracuse City. Pipelines that are assumed to be the responsibility of development are shown on the map (Appendix B, Figure 6-1) and do not have cost estimates included in the report. They are only shown schematically on the map (Appendix B, Figure 6-1) to represent locations to loop the existing system.

7 – PRIORITIZED IMPROVEMENTS COSTS AND SCHEDULE

7-1 SUMMARY OF COSTS

Detailed cost estimates for the above improvements are included in Appendix D. All cost estimates are calculated based on 2017 dollars. Locations of these projects are shown on the map in Appendix B, Figure 6-1.

A prioritization of projects to address existing deficiencies is summarized as follows in Table 7-1.

Table 7-1: Project costs to Address Existing Deficiencies

1	**Upsize tank transmission line from 10" to 16"**	$278,000
	TOTAL – PROJECTS TO ADDRESS EXISTING DEFICIENCIES	**$278,000**

A tentative prioritization of projects to address future deficiencies is summarized based upon expected growth patterns in Table 7-2. Projects in Table 7-2 reflect only those projects required through the year 2026 to address future deficiencies. The costs to address future deficiencies beyond 2026 were not included in the table because they cannot be included in an updated impact fee.

Table 7-2: Project costs to Address Future Deficiencies

1	Water Storage Tank-2.0 Mgallons at Freeport Center	$3,630,000
2	Water Storage Tank Property at Freeport Center	$290,000
3	Water Storage Tank Transmission Line at Freeport Center	$586,200
4	Water Storage Tank-4.0 Mgallons (portion of shared total)	$7,260,000
5	Water Transmission Line (portion of shared total)	$831,000
6	Water Rights Change Application to Add Points of Diversion	$25,000
	TOTAL – PROJECTS TO ADDRESS FUTURE DEFICIENCIES	**$12,622,200**

Costs to correct existing deficiencies and future deficiencies, or in other words to provide capacity for growth to the build out condition, are as follows:

Projects to Address Existing Deficiencies: **$278,000**

Projects to Address Future Deficiencies: **$12,622,200**

These summaries of cost represent approximate costs in 2017 dollars and are a general estimate. They are not as refined as a detailed cost estimate generated at the design phase. These costs do not represent all improvements or additions that will be made to the system.

There will be many other facilities installed as part of future development. The costs identified above are only for those improvements needed to meet minimum standards, or levels of service, at build-out. Other installed facilities will consist of lines to provide service to specific parcels.

7-2 IMPROVEMENTS SCHEDULE

Table 7-3 includes a schedule of all of the project improvements noted in the existing system and future system evaluation.

Table 7-3. Project Improvements Schedule

Type of Project		Year Needed	What Is Needed
Water Source/Supply, Water Rights, Water Storage	-	Prior to Project Improvements	Apply for a reduction in sizing criteria from DDW.
Water Source/Supply	Peak Day	Now	Review and renew WBWCD water supply contract.
	Peak Day	2036	Add an Additional water source.
	Average Annual	-	-
Water Rights	Peak Day	2032	Change the point of diversion of existing WR to Well #3, or other location
	Average Annual	-	-
Water Storage	Peak Day	2017	City has plans to construct a tank using existing impact fees. City plans to convert 1.0 MG tank to secondary system.
		2017	Add 2 MG tank at Freeport Center. (1 MG increase)
		2019	Renew contracts for water storage with HAFB and Clearfield City.
		2020	Add at least another 3 MG tank at HAFB.
		2032	Add at least another 2 MG tank at HAFB.
Water Distribution	Peak Day	Now	Upsize Freeport tank transmission line

8 – CONCLUSIONS AND RECOMMENDATIONS

Currently Syracuse is adequately supplying water and fire protection to its citizens with very few problems. As the community grows, however, the existing system will have shortfalls in specific areas. The first of these will be water storage. There is an immediate need for more storage to address storage deficiencies.

With continued effort the distribution system will be adequate to handle the growth expected in the community with the recommendations in the report. If Syracuse City continues with a proactive approach to water planning as they have done with this master plan, future challenges can be minimized and project costs reduced.

9 - REFERENCES

American Water Works Association (AWWA), Computer Modeling of Water Distribution Systems, Manual of Water Supply Practices M32, Second Edition, 2005.

Syracuse City, General Plan Map, dated December 24, 2015.

Syracuse City, personal communication regarding the number of connections, November 2016.

Syracuse City, Water Rights Forty-Year Plan, March 2014.
U.S. Census Bureau, Syracuse City population estimate, 2014.

Utah State Administrative Code, UAC R309-510,
<http://www.rules.utah.gov/publicat/code/r309/r309-510.htm>, accessed October 25, 2016.

APPENDIX A

APPENDIX B

APPENDIX C

APPENDIX D

APPENDIX E